

**REMARKS**

Claims 28-42 are pending in this application. Claims 28-40 are rejected under 35 U.S.C. §102(e) as anticipated by or, in the alternative under 35 U.S.C. §103(a) as obvious over Zachariah *et al.* U.S. Publication No. 2007/0207084 (referred to as “Zachariah”). Claims 41-44 are rejected under 35 U.S.C. §103(a) as being unpatentable over Zachariah in view of Mohri *et al.* U.S. Patent No. 6,521,203 (referred to as “Mohri”). Claims 28-41 are rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Japanese patent No. 2001/058818 (referred to as “JP '818”). Claims 41-44 are rejected under 35 U.S.C. §103(a) as being unpatentable over JP '818 in view of Mohri. These rejections are traversed for the following reasons.

The present invention includes a process for producing plate-like alumina particles by:

- a) forming a mixture of nano-sized particles of an aluminum precursor compound and a sufficient volume fraction of a diluent; and,
- b) heat treating the mixture to form substantially discrete plate-like alpha alumina particles dispersed in the diluents; and,
- c) wherein the step of heat treating the mixture is conducted below the melting point of the diluent.

The cited references fail to recite or consider production of plate-like particles.

**I. Rejections based on Zachariah**

**A. Novelty over Zachariah.**

The Office Action asserts that Zachariah teaches a process of making alumina particles wherein at least one nonreactive salt (the matrix salt) is used in a spray-pyrolysis system to form nanoporous particles.

The Examiner has the initial burden of establishing anticipation (MPEP §2106). To anticipate a claim, a single source must contain all of the elements of the claim (MPEP §2121). Zachariah does not teach the formation of plate-like alumina particles as required by claim 28, thus does not anticipate claim 28 or dependant claims 29-40.

Paragraphs [0041] to [0052] of Zachariah contain a lengthy and detailed discussion on how the parameters of spray pyrolysis (specifically matrix salt diffusion and precursor evaporate rates) can be manipulated to achieve a particular desired morphology and porosity of the final nanoparticles. Paragraphs [0092] to [0095] provide a lengthy and detailed analysis of the morphology of the nanoporous aluminum oxide particles produced by the Zachariah Examples as observed using scanning electron microscopy and transmission electro microscopy. The particles produced using the Zachariah process are porous “spherical, loosely aggregate particles” or highly spherical, nonporous particles following salt removal” (page 9, paragraph [0092] lines 30-31 and 39-40, respectively). The spherical or highly spherical particles of Zachariah are not “plate-like” particles as claimed. Therefore, claims 28-40 are not anticipated thereby.

As to claim 32 in particluar (reciting that the diluent is at least 80 volume % of the total mixture), Zachariah states that the molar ratio aluminum salt precursor to matrix salt must be in the range 1:1 to 1:5, and ideally between 1:1 and 1:3 for production of the disclosed nanoporous spherical particles (page 4, paragraph [0034], lines 8-14). In the Examples 1-6 (page 7 in Zachariah), whereby the precursor salt is aluminum nitrate and the matrix salt is sodium chloride, the resulting volume fraction of matrix salt in the dried droplets are within the range of 11% to 38% (molar ratio 1:1 - 1:5, respectively). This is well below the range specified in claim 32 which provides that the “sufficient volume fraction of the diluents is at least 80% of the total volume of the mixture.” Thus, claim 32 is not

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anticipated by Zachariah. Zachariah further discourages the use of relatively high matrix salt fraction because of the formation of large structures which leads to particles with a pore structure that is larger than the desired nanoporous structure of the invention (page 4, paragraph [0034], lines 5-8). Hence, Zachariah does not teach the process needed to produce plate-like alumina nano-particles nor the plate-like nano-particles themselves, therefore Zachariah does not anticipate claims 28-40.

**B. Non-obviousness over Zachariah.**

A *prima facie* case of obviousness may be rebutted by showing that the art, in any material respect, teaches away from the claimed invention (MPEP §2144.05). A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.

A person skilled in the art and faced with the problem of producing plate-like alumina particles would consider Zachariah irrelevant since it does not teach the production of plate-like alumina particles and it teaches away from the claimed invention, as discussed in the paragraphs above.

A rejection under 35 U.S.C. §103 requires a clear articulation of the reason(s) why the claimed invention would have been obvious (MPEP §2142). Therefore, the prior art, as a whole, must contain some implicit or explicit reason, suggestion, or motivation for a person of ordinary skill to modify the reference as proposed in the Office Action (MPEP §2143.01).

The Office Action does not provide such reason, suggestion, or motivation indicating how or why a person skilled in the art, and armed with the teaching of Zachariah, would have been motivated to either alter the heat treatment or adjust the volume fraction of

the diluents to form plate-like aluminum nano-particles. This is because Zachariah is entirely focused on the production of porous spherical aluminum particles. A reasonable expectation of success in the production of plate-like alumina particles by the proposed combination or modification would not be possible (MPEP §2143.02). Hence, claims 28-40 are non-obvious over Zachariah.

**C. Non-obviousness over combined teachings of Zachariah and Mohri.**

Claims 41-44 define over the teachings of Zachariah in view of Mohri. In the Office Action, the Examiner acknowledges that Zachariah does not expressly teach that the aluminum precursor is milled, but notes that Mohri teaches a process of treating alumina or aluminum hydroxide, including milling agglomerated coarse particles (page 4, lines 3-5 of the Office Action, referring to column 2, lines 21-35 of Mohri). However, at column 2, lines 30-31, Mohri teaches away from the treatment by stating that “grinding is not always easy and incurs the cost.” Furthermore, Mohri seeks to produce micron-size particles (not nano-size particles) and considers fine particles undesirable (*see*, column 2, lines 33-35, “fine powder may be formed or foreign materials may be incorporated only to provide  $\alpha$ -alumina powder unsuitable as an abrasive”). Even if Mohri is relied upon for teaching milling of aluminum precursor, neither Zachariah nor Mohri teaches the production of plate-like particles. Moreover, the references do not provide reason, suggestions, or motivation to combine their teachings (MPEP §2143). Thus, combining the references would not be obvious to the ordinary skilled artisan.

Finally, the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and there must be a reasonable expectation of success (MPEP §2143.02). Hence, since the references do not disclose the same plate-like aluminum nano-particles nor teach the process for production of these

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particles and, instead, teach away from the process needed to produce the particles, then there would not be a reasonable expectation of success in obtaining the plate-like aluminum nanoparticles.

Accordingly, claims 41-44 are not obvious to one skilled in the art in Zachariah in view of Mohri.

## **II. Rejections based on JP '818.**

### **A. JP '818 fails to teach or even consider how to produce plate-like aluminum particles.**

Claims 28-41 have been rejected as anticipated under 35 U.S.C. §102(b) or, in the alternative under 35 U.S.C. §103(a), as obvious over the JP '818 reference. We respectfully call attention to claim 41 since it is an independent claim and does not fall within claims 28-40. The rejection is understood to be relevant to claims 28-40.

The Office Action states that JP '818 teaches a platy  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> grain that is produced by heating  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> (page 4, line 12). More specifically, the JP '818 reference teaches the production of a platy  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> grain by heating  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> with sodium sulphate (Na<sub>2</sub>SO<sub>4</sub>) which is used as a flux. The published English abstract of JP '818, states that the temperature, when heat-treating to produce  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>, is preferably regulated to  $\geq 900^{\circ}\text{C}$ , which is above the melting point of preferred diluents sodium sulfate ( $884^{\circ}\text{C}$ ) and sodium chloride ( $801^{\circ}\text{C}$ ). In the present application, claim 28 includes the step of heat-treating the mixture below the melting point of the diluent. When heat treatment is performed below the melting point of the diluent(s) or below the liquidus of the diluent-mineraliser system, intergrowth of plate-like particles is avoided by virtue of the fact that sufficient solid particles of the diluent are present to separate neighboring plate-like particles from one another during growth (page

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9, lines 22-28 of the present specification). Accordingly, JP '818 does not anticipate claims 28-40 since it does not contain each and every element of the claimed subject matter.

In relation to obviousness, the Office Action does not indicate how or why a person skilled in the art and armed with the teachings of JP '818 would have been motivated to alter the heat treatment in performing the process of JP '818 without using a molten flux. The process as disclosed in JP '818 would not produce the plate-like aluminum nano-particles because the temperature is too high to avoid intergrowth of plate-like particles and, therefore, there would not be a reasonable expectation of success. In this regard, JP '818 teaches away from the present invention by stating  $\geq 900^{\circ}\text{C}$  is the preferred heat-treatment temperature for the disclosed invention (paragraph [0012] in JP '818). Thus, claims 28-40 are non-obvious over JP '818.

**B. Mohri does not cure the deficiencies of JP '818.**

As to claims 41-44, the Office Action acknowledges that JP '818 does not expressly teach that the aluminum precursor is milled but, instead, relies on the teachings of Mohri, as discussed above.

The references being combined must provide a reason, suggest, or motivate one skilled in the art of the desirability and thus the obviousness of making the combination (MPEP §2143). Moreover, the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and there must be a reasonable expectation of success (MPEP §2143.02). Here, again, there is no reason, suggestion, or motivation to combine the references. In addition, and based on the arguments in the preceding paragraphs, there would not be a reasonable expectation to succeed in producing the plate-like aluminum nano-particle in light of JP '818 in view of Mohri. Thus, claims 41-44 define over their teachings.

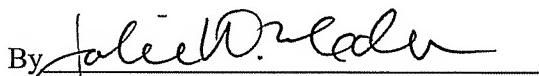
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**III. Conclusion.**

For the reasons stated herein, reconsideration and withdrawal of all rejections is respectfully requested.

Pursuant to a telephone conversation on November 16, 2007 with Applicant's representative, Foreign Patent EP 0679611, which is listed on the Information Disclosure Statement filed on March 9, 2006 and cited in the International Search Report, should be acknowledged as considered.

Respectfully submitted,  
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